

December 2011 MSS/LPS/SPS Joint Subcommittee Meeting

ABSTRACT SUBMITTAL FORM

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ABSTRACT INFORMATION

Title: Spin Start Line Effects on the J2X Gas Generator Chamber Acoustics

Submitted for consideration to: ☐ MSS ☒ LPS ☐ SPS

For inclusion in Technical Area: ☐ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

Security Classification of Presentation: ☒ Unclassified

Security Classification of Paper: ☒ Unclassified

Contract Number(s) Under Which Work was Performed: _____ ☐ IR&D

Is this paper an update? ☐ Yes ☐ No Has it been presented elsewhere? ☐ Yes ☐ No Is this a student paper? ☐ Yes ☒ No

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Unclassified Abstract

(250-300 words; do not include figures or tables)

The J2X Gas Generator engine design has a spin start line connected near to the turbine inlet vanes. This line provides helium during engine startup to begin turbomachinery operation. The spin start line also acts as an acoustic side branch which alters the chamber's acoustic modes. The side branch effectively creates 'split modes' in the chamber longitudinal modes, in particular below the first longitudinal mode and within the frequency range associated with the injection-coupled response of the Gas Generator. Interaction between the spin start-modified chamber acoustics and the injection-driven response can create a higher system response than without the spin start attached to the chamber. This work reviews the acoustic effects of the spin start line as seen throughout the workhorse gas generator test program. A simple impedance model of the spin start line is reviewed. Tests were run with no initial spin start gas existing in the line, as well as being initially filled with nitrogen gas. Tests were also run with varying spin start line lengths from 0" to 40". Acoustic impedance changes due to different spin start gas constituents and line lengths are shown. Collected thermocouple and static pressure data in the spin start line was used to help estimate the fluid properties along the line length. The side branch impedance model was coupled to a chamber impedance model to show the effects on the overall chamber response. Predictions of the spin start acoustic behavior for helium operation are shown and compared against available data.